

CHAPTER 12

COMPONENTS OF THE NAVY

LEARNING OBJECTIVES

Upon completion of this chapter, you should be able to do the following:

1. Identify the basic parts of fixed-wing and rotary-wing aircraft.
2. Describe the method of identification of various types of naval aircraft.
3. Identify the various aircraft used by the Navy.
4. Describe the planning and conduct of an air strike.
5. Describe the capabilities and the Navy's use of surface action groups.
6. Explain the Navy's role in fire support missions.
7. Explain the role of combat air patrol aircraft in antiair warfare.
8. Describe the capabilities of Navy ships to counter enemy missiles.
9. Identify the roles of surface ships, aircraft, and submarines in antisubmarine warfare.
10. Describe the shipboard antisubmarine warfare organization.
11. Describe how sonar is used in the detection of submarines.
12. Identify the phases of an amphibious operation.
13. Identify the methods of communication used by the Navy.

Essential to the Navy in the performance of its mission are various components and warfare areas. In this chapter, we discuss some of these components and warfare areas and some of the organizations that assist in their planning and operations. We discuss other branches or elements of the Navy that also provide support to these components and warfare areas in other chapters.

NAVAL AVIATION

SIGNIFICANT DATES

- 4 Mar. 1911 Congress provides \$25,000 to develop aviation for naval purposes.
- 8 May 1911 Navy orders first airplane.
- 20 Jan. 1914 Navy establishes first school for naval air training in Pensacola, Florida.

- 26 Oct. 1922 First carrier landing occurs on a ship underway aboard USS Langley. First catapult launch from an aircraft carrier occurs 1 month later.
- 28 Nov. 1929 LCDR Richard E. Byrd makes first flight over South Pole; becomes the first pilot to fly over both Poles.
- 23 Jul. 1947 First delivery of a "pure-jet" fighter, the FJ-1 Phantom, to a Navy squadron takes place.
- 9 Apr. 1959 Under Project Mercury, the astronaut program selects four naval aviators among seven persons as prospective astronauts.

The history of naval aviation goes back to the turn of the century when an Army-Navy board studied designs for the Langley “flying machine.” Afterward, members of the board agreed that aircraft could be developed for use in warfare.

The first naval officer selected for flight training was Lieutenant T.G. Ellyson. In December 1910 Ellyson received orders to undergo instruction with Glenn Curtiss, producer of the first practical hydroplane. Curtiss also trained the pilot who made the first shipboard takeoff from USS *Birmingham* in 1910—Eugene Ely. Ely later made the first successful aircraft landing on the deck of a ship, the armored cruiser *Pennsylvania*.

In July 1911 the Navy received its first airplanes—a Wright landplane for training and a Curtiss hydroplane. The next year Lieutenant Ellyson proved the feasibility of the newly devised compressed-air catapult by flying a plane shot from a barge.

From that time until the present, the Navy has tried four distinct approaches to integrating aeronautics with the fleet. It has used carriers, flying boats, lighter-than-air craft, and pontoon aircraft that operated from noncarrier ships. Using these approaches has taken naval aviation through two eras. During the first era propeller-driven combat aircraft flew from small, straight-deck carriers while pontoon planes operated from large men-o-war. Great flying boats flew antisubmarine warfare (ASW) patrols and were serviced by seaplane tenders, and huge rigid and nonrigid lighter-than-air craft roamed the skies. The second era exists today. This era of modern naval aviation consists of jet-powered aircraft; giant carriers; helicopters; and large, long-range patrol planes. During both of these eras, naval aviation has enjoyed success.

Soon after the attack on Pearl Harbor on 7 December 1941, American carriers dispelled any doubts about the effectiveness of shipboard aviation. Carriers that fortunately were absent from the scene that fateful morning delivered forceful retaliatory blows on enemy installations in the Pacific.

Naval aviation has come a long way since its beginning in 1910. As naval aircraft have become increasingly more advanced over the years, they have been used in many ways. Today’s naval aircraft fall under one of two categories: fixed wing or rotary wing.

FIXED-WING AIRCRAFT

A fixed-wing aircraft maybe divided into three basic parts: fuselage, wings, and empennage.

The fuselage is the main body of the aircraft, containing the cockpit and, if there is one, the cabin. On virtually all naval fighter and attack aircraft operational today, engines are mounted within the fuselage, as are some of the fuel tanks.

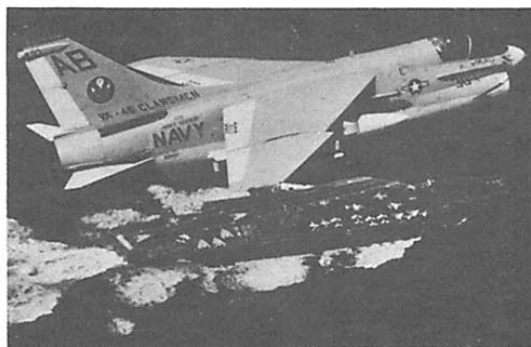
Wings are the primary lifting devices of an aircraft, although the fuselage and tail provide some lift. Several devices located on the trailing (rear) edge of the wings help control the aircraft. Flaps give extra lift on takeoff and slow the aircraft in flight or landing. Ailerons control the roll, or bank, of the aircraft. Trim tabs aerodynamically unload the control surfaces to relieve some of the pilot’s work.

Auxiliary lifting devices, resembling flaps, located on the leading (front) edge of the wing increase the camber (curvature) of the wing for added lift on takeoff.

Most Navy jet aircraft carry their bomb loads on pylons (called stations) under the wings and, in some cases, under the fuselage. Some jets have missile stations on the sides of the fuselage. Fuel cells are fitted inside the wings; additional tanks are fitted on the outside of the wings for extra range. Larger jets may have their engines slung beneath the wings in pods. On some low-wing aircraft, the main landing gear retracts into the wings while the nose wheel retracts into the fuselage. On most high-wing aircraft, such as the A-7, all gears retract into the fuselage.

The empennage consists of the stabilizing fins mounted on the tail section of the fuselage. The vertical stabilizer, upon which is generally mounted the rudder, controls yaw (the direction of the nose about the vertical axis). The horizontal stabilizer, on the trailing edge of which are the elevators, determines the pitch (climb or dive). Some supersonic aircraft may have a full delta wing. These aircraft have no horizontal stabilizer, and their elevators and ailerons are combined into control surfaces called elevons. In aircraft with internally mounted jet engines, exhausts are normally located in the tail. High-performance jets have afterburners that give additional thrust at the cost of greatly increased fuel consumption.

Rudder, ailerons, and elevators are collectively grouped as control surfaces. The ailerons and elevators are controlled by the “stick” or a similar device in the cockpit. The rudder is controlled by foot pedals. On high-performance aircraft, aerodynamic pressures on these surfaces become too great for a pilot to overcome manually; hence, all high-speed models today have power-assisted controls. Figure 12-1 shows representative types of fixed-wing aircraft.



A-7E CORSAIR II



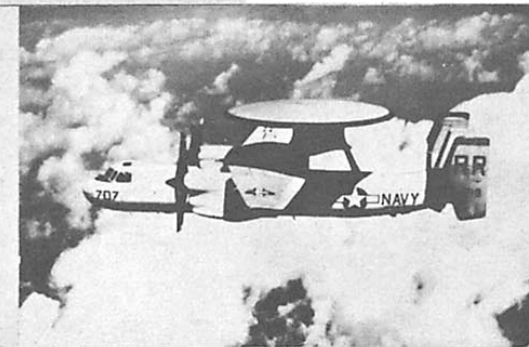
A-6 INTRUDER



F-14 TOMCAT



F/A-18 HORNET



E-2C HAWKEYE



P-3 ORION



S-3 VIKING



C-9 SKYTRAIN

Figure 12-1.—Representative types of fixed-wing aircraft.

Fighter Class

Fighters are high-performance aircraft generally employed to gain air superiority. They may be deployed defensively as interceptors, offensively as escorts for bombers or during ground support missions, or independently to counter enemy aircraft. Some are capable of carrying sufficient payloads for collateral bombing missions.

F-14A TOMCAT. —The F-14A Tomcat is a supersonic, twin-engine, variable-sweeping wing, two-place fighter. It replaced the venerable F-4 Phantom II series of fleet air defense fighters (the last one of which was phased out in 1986). It can track up to 24 targets simultaneously with its advanced AWG-9 weapons control system. It can attack six targets with Phoenix (AIM-54A) missiles, while continuing to scan the airspace. Its armament also includes a mix of other air intercept missiles, rockets, and bombs. F-14s provided air cover for the joint strike on Libyan terrorist-related targets in 1986.

The F-14 is the world's foremost all-weather, day-night fleet air defense fighter. The F-14A was introduced in the mid-1970s. The upgraded F-14A+ version, with its new GE F-110 engines, is now widespread throughout the fleet. It is more than a match for threat fighters in the close-in, air combat arena. The follow-on F-14D is designed to close emerging gaps in the carrier battle group's outer air capability against new-generation Soviet bombers and cruise missiles.

F/A-18 HORNET. —The single-seat F/A-18 Hornet is the nation's first strike fighter. It was designed for traditional strike applications, such as interdiction and close air support, without compromising its fighter capabilities. With its excellent fighter and self-defense capabilities, the F/A-18 concurrently increases strike mission survivability and supplements the F-14 Tomcat in fleet air defense. It thus acts as a true force multiplier, providing operational commanders the flexibility to employ it in either its fighter or its attack role.

F/A-18s can operate both from aircraft carriers and ground bases. They were part of the two-carrier battle force that conducted a joint strike on selected Libyan terrorist-related targets in 1986. They provided fleet air defense and, together with carrier-based A-7 Corsairs, used antiradiation missiles to neutralize air defenses.

Attack Class

Although attack planes are used for low-level bombing, ground support, or nuclear strikes, they do not need the speed of fighters. They have good stability, can carry heavy payloads, and can carry enough fuel to remain on station long enough to render extended support to troops, if needed. Attack aircraft normally operate under conditions of good visibility, but the A-6 has the equipment needed for all-weather and night attacks.

A-6E INTRUDER. —The A-6E is an all-weather, two-seat, subsonic, carrier-based attack aircraft. It is equipped with a microminiaturized digital computer; a solid-state weapons release system; and a single, integrated track and search radar. The target recognition attack multisensory (TRAM) version of the A-6E was introduced to the fleet in 1979. It is equipped with a chin turret containing a forward-looking infrared (FLIR) system and a laser designator and receiver.

The A-6E again proved it is the best all-weather precision bomber in the world in the joint strike on Libyan terrorist-related targets in 1986. With Air Force FB-111s, A-6E Intruders penetrated the sophisticated Libyan air defense systems. Since the Libyan air defense system had been alerted by the high level of diplomatic tension and by rumors of impending attacks, it was ready to retaliate. Although the strike force had to evade over 100 guided missiles while flying at low levels in complete darkness, it delivered laser-guided and other types of ordnance on target.

A-7E CORSAIR II. —The A-7E Corsair II is the current fleet version of the A-7. After more than two decades of service, however, it is due to be replaced by the F/A-18 Hornet. The A-7E has a 20-mm gun, can carry payloads of up to 15,000 pounds of bombs and missiles, and has eight ordnance stations.

A-7E Corsair IIs were part of the two-carrier battle group that conducted a joint strike on selected Libyan terrorist-related targets in 1986. Together with carrier-based F/A-18s, A-7s used antiradiation missiles to neutralize Libyan air defenses.

F/A-18s are scheduled to replace A-7Es in the carrier air wings. The last two A-7E squadrons are scheduled to make the transition in fiscal year 1992.

AV-8B HARRIER. —The AV-8B is a single-engine, single-crew-member aircraft capable of vertical/short takeoff and landing (V/STOL) operations. Operated by the U.S. Marine Corps, it was designed to be highly responsive to the needs of ground forces for close air support. Its V/STOL capability enables it to operate from relatively unprepared sites close to the action, thus increasing its sortie rate. It also can operate from U.S. Navy amphibious assault ships. The AV-8B is built primarily by McDonnell Aircraft Company, a division of McDonnell-Douglas Corporation, with major contributions by British Aerospace. The predecessor to the AV-8B, the British Aerospace's AV-8C, was introduced to the U.S. Marine Corps in 1969. The British version of the aircraft saw a great deal of action during the 1982 Falklands War.

Other Fixed-Wing Aircraft

The Navy uses different aircraft in various roles, ranging from early warning to submarine patrol. Some of these aircraft are discussed in the following paragraphs.

E-2C HAWKEYE. —The E-2C Hawkeye is the U.S. Navy's all-weather, carrier-based tactical airborne warning and control system platform. An integral component of the carrier air wing, the E-2C carries three primary sensors: radar, identification friend or foe (IFF), and a passive detection system. These sensors are integrated with a general-purpose computer. This computer enables the E-2C to provide early warning, threat analyses, and control of counteraction against air and surface targets. The E-2C incorporates the latest solid-state electronics.

F-14 Tomcat fighters provided combat air patrol during the two-carrier battle group joint strike against terrorist-related Libyan targets in 1986. The carrier-based E-2C Hawkeye directed the F-14 Tomcat fighters during the strike and during the crisis periods preceding and following the strike. E-2Cs and Aegis cruisers, working together, provided total air mass superiority over the American fleet. American aircraft intercepted 153 Libyan air force attempts to overfly the U.S. fleet, intercept the U.S. fighter combat air patrol, or gather intelligence information. Not once did a Libyan aircraft get into firing position before a U.S. aircraft or Aegis platform missile locked it into its sight.

E-2 aircraft also have worked effectively with U.S. law enforcement agencies in drug interdiction operations.

The E-2C replaces the E-2B, an earlier version. E-2C aircraft entered U.S. Navy service in November 1973.

EA-6B PROWLER. —The EA-6B Prowler is a four-seat derivative of the highly successful A-6 Intruder medium attack aircraft. Among its features are a computer-controlled electronic surveillance and control system and high-power jamming transmitters in various frequency bands. The jamming transmitters are contained in pods mounted externally on the five aircraft pylons. Aircraft capabilities can be varied throughout the frequency spectrum by varying the mix of jamming transmitters on the aircraft.

EA-6B Prowlers played an important role in the joint strike on Libyan terrorist-related targets in 1986. Working with Air Force EF-111 Ravens, Navy and Marine Corps Prowlers jammed Libyan air defense surveillance. That enabled carrier-launched Navy A-6E Intruders and land-based Air Force FB-111s to put their ordnance on target.

An EA-6B improved-capability (ICAP II) aircraft modernization program is underway to upgrade the entire EA-6B inventory. The first ICAP II-equipped EA-6B squadron provided flawless coverage for the joint USS *Saratoga* and Carrier Air Wing 17 HARM missile strike against Libya. ICAP II includes an inertial navigation system, the universal exciter jamming pod, updated displays, and the ability to interface with computerized mission planning systems. It provides the latest equipment to meet current and projected threats.

P-3C ORION. —The P-3C is a land-based, long-range antisubmarine warfare (ASW) patrol aircraft. It has advanced submarine detection sensors such as the directional frequency and ranging (DIFAR) sonobuoys and magnetic anomaly detection (MAD) equipment. The avionics system is integrated with a general-purpose digital computer. This computerized system supports all of the tactical displays and monitors and automatically launches ordnance, while providing flight information to the pilots. In addition, the system coordinates navigation information and accepts sensor data inputs for tactical display and storage. The P-3C can carry a mixed payload of weapons internally and on wing pylons.

S-3A VIKING. —The S-3A Viking is a carrier-based, subsonic, all-weather, long-range, high-endurance, turbofan-powered aircraft. It can locate and destroy enemy submarines, including newer high-speed, deep-submergence, quiet-running submarines. The S-3A operates primarily in the middle and outer carrier battle group anti-submarine warfare (ASW) zones with other ASW units—surface, airborne, and subsurface. It also can operate independently or in tandem with its long-range, land-based ASW partner, the P-3 Orion. Weapons carried by the S-3A include various combinations of torpedoes, depth charges, missiles, rockets, and special weapons.

ROTARY-WING AIRCRAFT

The aerodynamics of rotary-wing aircraft are considerably more complex than those of fixed-wing aircraft. A helicopter essentially consists of a fuselage, a main rotor or rotors, and often a tail rotor. The fuselage, as in fixed-wing craft, contains the cockpit and cabin.

The main rotor is the approximate equivalent of the wing of a fixed-wing aircraft; each rotor blade is an airfoil, like a wing. The rotation of the main rotor assembly creates a flow of air over the blades that generates lift. The aerodynamic forces on the rotor lift the helicopter into the air; it is not pushed up by the downwash. Some helicopters have twin rotors in tandem at either end of the fuselage. Most have a single, main rotor with a tail rotor mounted at right angles. A few have tandem intermeshing rotors.

The tail rotor (on helicopters that have one) provides directional control and stability. It is mounted at right angles to the main rotor to counteract the torque of that system. By varying the pitch of the tail rotor blades, the pilot controls yaw. By effectively tilting the entire main rotor, the pilot determines the pitch and roll. By simultaneously increasing the pitch on all blades on the main rotor, the pilot causes the helicopter to climb. (The pitch is essentially how large a bite of air the blades take, as distinct from aircraft pitch.)

A transmission, which may be disengaged, connects the helicopter engines to the rotor shaft(s). That permits operation of the engine(s) on the ground without engagement of the rotor system and a mode of flight known as autorotation. If the engines should stop while in flight, the pilot can disengage the transmission; the freewheeling action of the rotor will then allow a slower descent.

Since World War II, rotary-wing aircraft have become an indispensable part of naval warfare. Their applications seem limitless—ASW; pilot rescue; transfer of supplies, mail, and personnel within dispersed forces; amphibious warfare; evacuation of wounded; counterinsurgency; minesweeping; and others. Representative types are shown in figure 12-2.

SH-2F Seasprite

The Seasprite is a ship-based antisubmarine warfare (ASW) and antiship surveillance and targeting (ASST) helicopter. The SH-2F is equipped with a search radar, electronic support measures, magnetic anomaly detectors, and an acoustic data link. The helicopter also carries active and passive sonobuoys.

The prototype Seasprite flew for the first time in 1959. Since then, many versions have been produced for the Navy under its light airborne multipurpose system (LAMPS) program to provide helicopters for ASW and ASST operations.

SH-3H Sea King

The SH-3H is a twin-engine, all-weather, ship-based ASW helicopter. It is equipped with variable depth sonar, sonobuoys, data link, chaff, and a tactical navigation system.

The first version of this workhorse ASW helicopter was flown more than 20 years ago. The current model is equipped with sonar, active and passive sonar buoys, and magnetic anomaly detection equipment.

The Sea King, also used by some squadrons for search and rescue missions, is being replaced by the SH-60F Seahawk.

UH-46/CH-46 Sea Knight

The Sea Knight is another example of a durable and versatile aircraft that still provides valuable service more than two decades after its first flight. Both the Navy and the Marine Corps have flown various versions of it. The Navy has used the UH/CH-46 for vertical replenishment, and the Marine Corps has used the CH-46 for troop transport. Both the Navy and Marine Corps have used the CH-46 for search and rescue (SAR).

The Sea Knight can carry approximately 6,000 pounds of cargo in a sling beneath the fuselage. The CH-46E has been modified with much more powerful engines than earlier Navy and Marine Corps versions.



UH-1N TWIN ENGINE HUEY



SH-3 SEA KING



SH-2 SEASPRITE



RH-53 SEA STALLION



CH-46 SEA KNIGHT



TH-1L HUEY



SH-60B SEA HAWK

Figure 12-2.—Representative types of naval helicopters.

CH-53A/D Sea Stallion

The CH-53A/D assault/heavy-lift helicopter prototype first flew in 1964. A Navy aerial minesweeping version, the RH-53D, is basically a CH-53A/D with upgraded engines and special minesweeping gear.

CH-53E Super Stallion

The CH-53E Super Stallion is a shipboard-compatible helicopter. It is configured for the lift and movement of cargo and troops/passengers internally and the lift of heavy, oversized equipment externally. The Navy uses this aircraft for six missions: vertical onboard delivery (VOD) augmentation, transfer of damaged aircraft, mobile construction support, high-priority container transportation, nuclear weapons transportation, and airborne mine counter-measures (AMCM). The Marine Corps also uses the CH-53 for certain missions. They include tactical movement of heavy weapons and equipment, amphibious assault operations, recovery of downed aircraft (to include self-retrieval), V/STOL support, and special operations.

The great lifting capacity of the CH-53 makes it capable of lifting some of the Marine Corps' heavier weapons systems. It can lift systems such as the M-198 Howitzer and the different variants of the new light armored vehicle (LAV). Because of this lift capacity, the CH-53 provides greater assault capability.

The range payload capability of the Super Stallion gives it the ability to perform special operations in support of the rapid deployment force.

The MH-53E Sea Dragon is a multimission variant of the CH-53E and has significantly enhanced AMCM capability over the current Navy RH-53D helicopter. The AMCM improvements enhance the aircraft's capability to perform utility and special missions by significantly increasing range and navigation capability. The combined nomenclature designation of both aircraft is the CH/MH-53E.

Weighing 73,500 pounds, the CH/MH-53E is the largest helicopter in the western world. Its lift capacity provides increased military capabilities. It can deliver an external cargo of 16 tons within a 50-nautical-mile radius and can make a VOD of 9.8 tons within a 500-nautical-mile radius. These ranges can be further extended through in-flight refueling with KC-130s and helicopter in-flight refueling (HIR) with air-capable ships.

SH-60B Seahawk

The SH-60B Seahawk is the air subsystem of the LAMPS Mk III weapons system. LAMPS Mk III is a computer-integrated ship/helicopter system that increases the effectiveness of surface combatants. It does that by providing a remote platform for deployment of sonobuoys and torpedoes and an elevated platform for radar and electronic support measures. It also increases effectiveness by processing magnetic anomaly detector sensor information.

SH-60B Seahawk helicopters provided communications relay and visual surveillance services during the two-carrier battle group joint strike on selected terrorist-related Libyan targets in 1986.

The new SH-60F, designed to operate from carriers, is replacing the SH-3H as the carrier battle group inner antisubmarine warfare zone helicopter. It employs a new, longer-range active dipping sonar in addition to sonobuoys to track and attack submarines. Also incorporated are significant improvements in reliability and maintainability, plus vastly improved tactical capabilities.

AIRCRAFT MODEL DESIGNATIONS

All aircraft have tri-service designations. A given aircraft bears the same alphanumeric identification symbol regardless of whether the Navy, Army, or Air Force uses the craft.

Each basic designator consists of a letter and a number. The letter specifies the basic mission of the aircraft as follows:

A—Attack	R—Reconnaissance
B—Bomber	S —Antisubmarine
C—Cargo/transport	T—Trainer
E —Special electronic installation	U—Utility
F —Fighter	V—VTOL or STOL (vertical or short takeoff and landing capability)
H—Helicopter	
K—Tanker	
O—Observation	X—Research

The number (which may consist of one, two, or three digits) indicates the design number of the type of aircraft. The designator A-7 shows an aircraft to be the seventh attack design. If a particular design is modified, another letter (A, B, C, etc.) follows the design number; this letter identifies the number of the modification. For example, the second A in A-6A tells us that the original design of this attack plane has been modified one time.

When the original mission of an aircraft changes, a mission-modification letter precedes the basic mission symbol. These are as follows:

A —Attack	Q —Drone
C —Cargo/transport	R —Reconnaissance
D —Director (for control of drones)	S —Antisubmarine
E —Special electronic installation	T —Trainer
H —Search and rescue	U —Utility
K —Tanker	V —Staff
L —Cold weather	W —Weather
M—Missile carrier	

Thus, if the A-4 is modified to be used as a training aircraft, its alphanumeric identification becomes TA-4.

Other letters that frequently appear before a basic mission symbol or mission-modification letter are “special-use” symbols that indicate the special status of an aircraft. Currently, six special-use symbols are used:

G—Permanently grounded (for ground training)
J —Special test, temporary (when tests are complete, the craft will be restored to its original design)
N—Special test, permanent
X—Experimental stage of development
Y—Prototype (for design testing)
Z —Early stages of planning or development

STRIKING FORCE

A strike is an attack that is intended to inflict damage to, seize, or destroy an objective. A striking force is a force composed of appropriate units needed to conduct strike, attack, or assault operations.

Because of their mobility and versatile power, naval striking forces are ideal instruments for enforcing national military policy and settling outbreaks of hostilities. In peacetime, the existence of a naval striking force may serve as a stabilizing influence to inhibit the outbreak of hostilities.

If hostilities should occur in spite of attempts to settle international disputes by other means, the naval striking force is available immediately. It will take prompt and decisive action to accomplish national objectives.

Mobility is one of the greatest assets of naval striking forces. It makes surprise attacks possible from any point on the periphery of an enemy land area bounded by navigable waters. The versatility of a striking force permits the use of a wide variety of weapons systems from either distant or close ranges.

AIR STRIKES

An air strike is an attempt by a group of aircraft to inflict damage on an enemy target.

Before an air strike is made against targets ashore, the strike planners will formulate and consider a plan of attack. First they meet in the carrier intelligence center (CVIC) to view all of the information the air intelligence officer makes available to them. They use the latest technology available in the planning of their missions. One system they use is the tactical air mission planning system (TAMPS). It automatically performs most of the more tedious planning steps strike planners previously did manually.

Once the plan is complete, all pilots who will take part in the actual strike attend a detailed briefing. The briefing covers all known information that might contribute to the success of the mission. It includes enemy strength; location or probable location of the enemy; recovery of “safe” areas; weather conditions; location of friendly forces; and, if possible, target priorities. The method of delivering the attacks and the weapons selected depends on several elements. They include the construction of the target, whether the tactical situation calls for a day or night attack, and the weather conditions at the target.

The three classes of modern tactical air-to-surface weapons are standoff outside area defense (SOAD), standoff outside point defense (SOPD), and close-in (CI) weapons. The range at which each specific weapon can be used most efficiently determines its classification. We can assume that the longer a weapon's range, the "smarter" it has to be; the "smarter" it is, the more expensive (and more accurate) it becomes. Therefore, strike planners must efficiently plan how to employ their weapons supplies to avoid running out of them before they can win the war!

Since weapons have become more and more expensive, those responsible for purchasing them have made a recent effort to make more efficient purchases. Classifying weapons as mentioned in the previous paragraph is one way they accomplish that because it reduces the number of different types available. In addition, it makes everyone's job easier because fewer types of weapons must be stored aboard ship and loaded aboard aircraft.

While planning a strike against enemy forces, battle group commanders must remember to plan for the defense of their own ships. The air defense of a carrier battle group is formidable, built on a "defense-in-depth" philosophy. Fighter aircraft carrying air-to-air weapons serve as the carrier air wing's contribution to fleet air defense. Tanker aircraft from the air wing refuel the fighters. The fighters, coordinated by ship or airborne controllers, will either be airborne or on the carrier's catapults ready for an immediate launch, depending on the tactical situation.

SURFACE ACTION GROUPS (SAG'S)

The operation orders of a task force or group commanders provide for surface action groups (SAGs) that can perform certain missions. These missions include antisubmarine warfare (ASW), antisurface warfare (ASUW), and strike warfare, to name a few. A battle plan is prepared for these forces on the assumption that they will encounter surface action. However, such a force is usually only one element of a coordinated strike by both air, subsurface, and surface units.

Surface action in the modern Navy means much more than exchange of naval gunfire. The introduction of antiship cruise missiles, such as the Harpoon and the Tomahawk antiship missile (TASM), has revolutionized war at sea.

A coordinated strike against an enemy SAG may well include surface-, sub-, and air-launched Harpoon missiles; surface- and sub-launched TASM's; and air-launched ordnance. Forces may require the use of one or more of these weapons

systems in addition to traditional naval gunfire to sink disabled enemy hulks. A coordinated air and cruise-missile strike may surprise an enemy SAG so much that it may cause one of two results. First, the surface action may become a pursuit of disorganized enemy forces. Second, the strike may slow enemy forces so that they cannot bring their own surface missile systems to bear upon the carrier or other essential units in the battle group.

Special situations may require SAGs to destroy isolated or crippled enemy surface units, execute a deep land strike, conduct naval gunfire shore bombardment, and perform surface reconnaissance missions. Today's modern surface force can take on all these missions with or without accompanying tactical air support.

The deployment of Tomahawk land attack missiles (TLAMs) has turned both surface ships and submarines into potent strike platforms. These strike platforms can be widely dispersed throughout the battle group.

The ability to conduct covert strikes from submarines brings a new dimension to naval warfare. Future development will bring land attack cruise missiles with even longer attack ranges. We need these missiles to further disperse surface forces and still conduct strike warfare while minimizing the involvement of the carrier air wing.

FIRE SUPPORT

Although often considered a phase of amphibious operations, surface forces may be called upon to provide gunfire support for troops ashore. During World War II that was accomplished primarily by a force of battleships, cruisers, and destroyers. These forces spent hours, and even days, bombarding the enemy ashore to try to destroy as many fortifications as possible before troops hit the beaches. After the landings, ships provided support as tactical circumstances dictated. Since the enemy showed less opposition to landings during the Korean and Vietnam wars, forces mainly provided fire support in response to tactical circumstances,

As you may recall, USS *New Jersey*, along with other surface ships, took part in fire-support missions in Beirut, Lebanon, in 1983.

ANTI-AIR WARFARE

Anti-air warfare (AAW) includes all measures designed to nullify or reduce the effectiveness of attack by hostile aircraft or guided missiles.

Active AAW includes the use of aircraft, anti-aircraft guns, missiles, and electronic countermeasures. (Electronic countermeasures are employed to jam radars, mask or monitor electronic transmissions, confuse guidance systems, present false targets, and the like.) Passive AAW—measures other than active, taken to minimize the effects of hostile air action—involves elements such as cover, concealment, and dispersion.

Ships and aircraft are joined in a task formation to accomplish a mission that has been dictated by strategic necessity. An AAW formation is designed to protect a carrier, which is the offensive striking unit of a carrier task force or battle group.

As enemy aircraft approach in a strike against our ships at sea, our forces may divide defensive AAW operations into three phases occurring successively. The first phase involves the use of personnel and equipment to search for, find, evaluate, and report the enemy attack force. The second phase involves initial active AAW defense measures—taken while attacking aircraft are at a considerable distance from the force. These measures may include electronic deception; aircraft interception; and long-range, surface-to-air, guided-missile fire. The third phase, close-range defense, takes place when attacking aircraft have penetrated near or within gun range of the main body of ships being defended. Close-range defense measures consist of gunfire, short-range missiles, and evasive maneuvering.

Speeds of modern aircraft and missiles require that defensive measures be taken as early as possible at the greatest practicable distance from the attacking force. An AAW operation, therefore, uses distant early warning aircraft, such as the E-2, and surface picket ships, such as guided-missile destroyers. Depending on the size of the formation and nature of the threat, several sector anti-air warfare coordinators (SAAWCs) may conduct operations in designated areas. SAAWCs report to the force anti-air warfare coordinator (FAAWC) who then coordinates defenses over the entire task force area of responsibility.

The FFAWC normally determines the extent of the anti-air warfare area, which encompasses the total region to be protected from enemy air attack. Figure 12-3 maps the subdivisions of the AAW area. Concentric circles surround the main body of ships at distances determined by the nature of the expected attack. The circles represent the outer perimeters of the subdivisions. The surveillance area, the outer limit of which

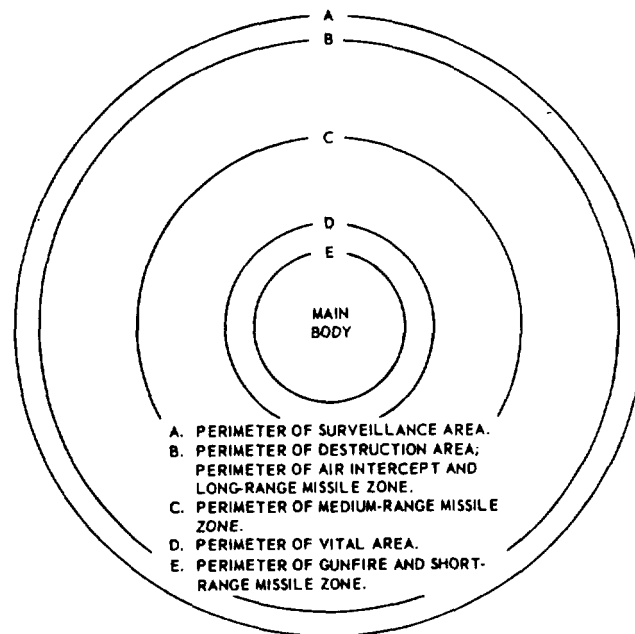


Figure 12-3.-The force anti-air warfare coordinator (FAAWC) determines the extent of the AAW area.

corresponds to the perimeter of the entire AAW area, is the region of search, detection, and tracking. The destruction area is the sector (within the surveillance area) in which destruction or defeat of the enemy airborne threat should occur. It is divided into an air-intercept and long-range missile zone, medium-range missile zone, and gunfire/short-range missile zone. The vital area contains the main force of ships that must be defended.

The AAW area usually is oriented about an AAW axis, or threat axis. The AAW axis is a true bearing from the vital area to the most probable direction of enemy attack. Early warning aircraft and ships normally are deployed along the AAW axis. A number of factors affect the choice of an AAW disposition. These include the submarine threat, available ships and aircraft, fuel, amount of protection required, and weather. Whenever possible, mutual support from nearby units is obtained through the overlapping of AAW areas.

Although conventional gunfire can be effective in AAW, high-speed jet aircraft have made defense by gunfire a last-ditch effort. At 600 miles per hour, an attacking aircraft is within effective range of a 5-inch gun for less than a minute before the plane reaches its drop point. This speed allows, at best, about 100 rounds of gunfire from one ship. In World War II we expended an average of 3,000 rounds of all types to down each propeller-driven aircraft.

Defense against an air attack demands a high degree of coordination between widely dispersed units in the formation. Attacking aircraft can climb to very high altitudes, or they can come in just over the wave tops. No matter what their altitude, the speed of the aircraft is often supersonic. That means instantaneous reactions and quickly computed solutions are essential to the defenders. Even after attaining maximum proficiency, a ship's individual efforts would probably prove futile unless it were deployed in a defense-in-depth formation. Defense in depth requires intensive coordination. Teamwork is then the order of the day, and the captain of the team is the AAW coordinator.

The AAW coordinator and staff usually observe the entire picture on various display plots aboard a missile cruiser. The coordinator maintains communications, except during some conditions of electronic silence, with all the AAW units. The coordinator also receives all "bogey" (unfriendly air contact) information from the detecting ship or aircraft.

COMBAT AIR PATROL (CAP)

When an aircraft poses a definite threat, the AAW coordinator must decide which defense to use. The first line of defense is the on-station combat air patrol (CAP). If the CAP is in the target area, the relative speeds of the CAP and target may indicate a possible intercept. In such cases, the coordinator may order the AAW unit's CAP air controller (aircraft or surface ship) to vector the CAP to the target. On-station CAP aircraft orbit at a station between the inner and intermediate surface picket lines, roughly 30 miles from their controlling units.

CAP can miss the target for several reasons. Patrolling aircraft may be out of position, relative speeds may work against an intercept, or poor visibility and/or radar reception may make the CAP useless. When CAP proves ineffective, the AAW coordinator may employ long-range missiles or launch additional interceptor aircraft.

During CAP intercept attempts, shipboard weapons direction systems direct fire control radars aboard missile ships to the target. When a ship is ready to engage a target with missiles, it notifies the AAW coordinator and may order one or more missile launches. If more than one ship is prepared to assault a target with missiles, the AAW coordinator must decide which ship, or ships, will take part in the attack. The coordinator must consider, among other factors, which ship is in the best position for a kill and what type and number of missiles it has aboard.

Missile ships may be stationed in the extended (outer), intermediate, or inner screen position. However, they should remain either far enough in or out to allow the CAP to operate freely. Since a missile ship usually is free to fire on any target that enters its envelope, a well-defined crossover point must be designated. A crossover point is the range at which a target ceases to be an air intercept target and becomes a surface-to-air missile target. Air controllers must be careful to keep CAP aircraft from crossing this point to prevent their destruction by friendly fire.

If CAP aircraft or long-range missiles do not stop an attack, the AAW coordinator may direct the carrier(s) to launch additional interceptor aircraft. Interceptors remain ready for launch in specified conditions of readiness as follows:

- Condition One CAP: Pilots strapped in cockpits; catapult and deck crews at stations; and all leads to engines plugged, ready for immediate ignition. Reaction time limited only to the time required to turn the carrier into the wind.
- Condition Two CAP: Aircraft ready to start; pilots and deck/catapult crews nearby rather than on station.
- Condition Three CAP: Launch capability required within 15 minutes. Pilots in ready rooms; crews relaxing near stations.
- Condition Four CAP: Pilots and crews on 30 minutes' notice.
- Condition Five CAP: Pilots and crews free until called.

ANTISHIP MISSILE DEFENSE (ASMD)

The antiship missile defense (ASMD) program significantly improves a ship's capability in countering high-speed, low-altitude, anti ship missile threats. In attaining this defense posture, the program requires modifications to the overall ship combat system for the following purposes:

To enhance low-flyer and electronic warfare (EW) detection capabilities

To reduce reaction times by modifying command and control functions for weapons direction

To improve gun and missile system engagement capabilities

In addition to these combat system improvements, on-board training devices are installed to support combat information center (CIC) team training exercises. The ASMD program furthers the improvements provided by the ship's anti-missile integrated defense (SAMID) immediate program by expanding ship capabilities to counter antiship missile threats. The ASMD program integrates additional subsystems into the combat system. It makes use of expanded tactical data processing techniques by providing a fully automatic method of responding to particular antiship missile threats.

The gun weapons system supports that element of the ship's mission requiring offensive operation against air, surface, and shore targets. It provides this support through its ability to destroy these types of targets at ranges within the minimum-range capability of the guided-missile systems.

As in other types of warfare, successful AAW operations must be based in part on lessons learned through costly experience and must be practiced continually.

ANTISUBMARINE WARFARE

The basic elements of the Navy's antisubmarine warfare (ASW) forces include surface

ships, aircraft, and submarines. The integrated undersea surveillance system (IUSS) is also an integral part of our ASW system. This system cues our engagement forces to respond quickly to ASW tactical areas. These elements are capable of operating independently or with each other.

The basic mission of antisubmarine warfare is to deny the enemy the effective use of submarines. We must go beyond what we have learned in the past by developing new techniques to match the expanding role of the submarine. The long-range nuclear-missile capability of today's submarines requires that we do more than prevent submarine torpedo attacks on our shipping and naval vessels. Instead, we must find and keep under surveillance all enemy submarines before they can reach a point within missile-launching range of our coasts.

SURFACE UNITS

The surface ship has a greater variety of both detection equipment and weapons than any other ASW unit. A prime advantage of the surface ship is its ability to conduct all-weather operations and to remain on station for a comparatively long time.

Our most effective ASW surface ships today are frigates, destroyers, and cruisers equipped with SH-60B LAMPS helicopters (fig. 12-4).



109.17

Figure 12-4.-An SH-60B Seahawk helicopter in flight near the stern of a guided-missile frigate.

These ships use new and improved radar, sonar, electronic countermeasures, and communications systems to enhance their detection capabilities.

Another major surface unit is the aircraft carrier, with ASW aircraft embarked. A carrier can monitor midocean areas beyond the effective range of land-based patrol aircraft.

ASW AIRCRAFT

Aircraft have the ability to investigate distant contacts rapidly and are relatively invulnerable to submerged submarines. They also have the advantages of speed, relatively long range, and weapons-carrying capability. Therefore, they may fulfill the antisubmarine mission independently or in coordination with other types of anti-submarine units.

The three basic antisubmarine warfare aircraft are long-range patrol aircraft, medium-range carrier-based aircraft, and helicopters. We described some of these aircraft, primarily the P-3C Orion, the S-3A Viking, and the LAMPS III helicopters, earlier in this chapter. These aircraft use a wide variety of electronic devices to detect submarines.

The magnetic anomaly detection (MAD) device is used mainly for submarine classification purposes. Depending on the height of the aircraft and other variables, it can detect a submarine by variations in the earth's magnetic lines of force. Because of its limited range, MAD is unsuitable as a device for open area searches. However, it is effective when used in geographically or tactically defined or restricted small areas. Aircraft normally use the MAD device to detect the specific location of a submarine before they attack it.

Expendable sonobuoys, used with measured success against submarines of the last war, are very useful against submarines in a variety of tactical situations. Sonobuoys are tubes containing a hydrophore and radio transmitter. As aircraft drop them into the water, the hydrophores pick up sounds and broadcast them to surface craft or aircraft. Each sonobuoy is on a slightly different frequency. An active buoy is also used that emits a sound signal and listens for the return echo.

Since helicopters are capable of hovering, they use a different piece of equipment. The aircraft, by means of a long cable, lowers a cylindrical sonar transducer into the water while hovering over the suspected contact area. With this gear

the helicopter can listen or echo-range (determine the location of a submarine).

Other methods of detection include infrared detection and explosive echo ranging using sonobuoys.

In all types of airborne electronic ASW devices, proper training of both operating and maintenance personnel is paramount to successful application of the equipment. Certain applications require special techniques for effective use of sonobuoys and other sonic devices. Proper and accurate sound identification and spotting of snorkel targets on radarscopes are examples.

ASW SUBMARINES

The submarine itself is perhaps the most effective antisubmarine vehicle. It operates in the same medium as the target and shares the target's advantages of concealment and passive detection. (Passive sonar depends entirely on the target's noise as the sound source rather than the returned echoes of a transmitted signal.) The submarine can detect enemy submarines while working with other ASW forces or while working independently. Submarines can precede carrier strike forces into enemy waters, function as ASW screens, and operate as minelayers. Fleet ballistic missile submarines are used to destroy enemy targets when ordered by the President of the United States.

SOUND NAVIGATION AND RANGING (SONAR)

The use of sonar (sound navigation and ranging) is the principal method of submarine detection. We have two types of sonar—passive and active. Sonar is an electronic device that either detects underwater sounds or transmits them. Passive sonar detects sounds originating under water. Active sonar is an electronic device that can transmit (through the depths) a sound wave which, upon striking an object, will reflect. Submarines use passive sonar to enable them to detect noise-making objects without transmitting a telltale ping themselves.

To understand how sonar works, you must first understand sound. Sound is the physical energy that causes the sensation of hearing. It travels in the form of waves away from the point of origin, as ripples travel out in all directions from a pebble tossed into a pond. Echoes are created when sound waves strike objects through which they cannot travel and therefore bounce back to the source.

The substance through which sound travels is called a medium. All types of matter are sound mediums of varying efficiency. The denser the medium, the more rapidly sound travels through it. Therefore, steel is a better medium than water, and water is a better medium than air.

Let us take a look at what happens to a sonar impulse after it leaves the transducer (the transmitting device in the water). The transducer introduces the sound wave into the water by converting the equipment's electrical energy into sound vibrations. The impulse travels at a rate of between 4,700 and 5,300 feet per second, depending on the temperature, salinity, and pressure of the water. The rate of travel of the impulse is four or five times faster than the speed of sound in air. However, the hazards of travel take their toll on its speed and signal strength. Current, bubbles, and wakes absorb some of the sound. As the impulse passes through foreign matter such as seaweed, silt, and animal life in the water, it scatters and becomes even weaker. As the sound wave travels away from the transducer, it spreads out like a searchlight beam. The further away it travels from the transducer, the weaker it becomes.

Once the wave strikes an object such as a submarine, that portion of the impulse which is at a right angle to the object reverberates toward the sonar receiver. Again absorption, scattering, and spreading will affect the strength of the impulse. However, it will still signal a possible target unless multiple reflections, or echoes, such as reverberations, self-noise, and a high surrounding noise level, drown it out.

Multiple reflections, or echoes, can come from many sources. Sound waves bouncing off small objects such as fish or air bubbles produce small echoes. Sound waves reflected from the sea surface and bottom also cause echoes, and the sea mass itself causes reverberations. These reverberations appear on video and audio receivers. Reverberations from nearby points may be so loud on the audio receiver that they interfere with, or completely mask, the returning echo from the target.

SHIPBOARD ASW ORGANIZATION

Sonar control is the major shipboard ASW station. Other stations are the bridge, the combat information center (CIC), and the ASW weapons batteries. On most ships this organization is integrated into the combat systems department.

Sonar control is the ASW station that maintains a continuous underwater search for submarines. From the bridge, the officer of the deck conns the ship, keeping other control stations informed of the ship's maneuvers.

The combat information center is the key station for coordinating search/attack operations within the ship and between ships and/or aircraft. Personnel in CIC plot, display, evaluate, and disseminate all air, surface, and subsurface contact information and recommend search plans to the commanding officer.

In modern ASW ships, the captain and the tactical action officer (TAO) often direct the attack from CIC. However, the CO may choose to remain on the bridge. When that happens, repeaters duplicate information from CIC for the captain's use while phone talkers relay amplifying information to him. That enables the captain (in conjunction with the TAO in CIC) to evaluate critical elements of the attack from his position on the bridge. After evaluating elements such as the target's course and speed, the captain can then authorize delivery of the necessary ASW weapons.

AMPHIBIOUS WARFARE

Amphibious warfare encompasses many different types of ships, aircraft, weapons, and landing forces used in a concerted military effort on a hostile shore. An amphibious operation is an attack launched from the sea by naval and landing forces. The landing forces, transported by afloat landing craft and helicopters, may include Army and Marine Corps troops. During such operations, both surface ships and aircraft usually bombard the hostile shore immediately before the landing.

Amphibious operations are conducted to establish a landing force on a hostile shore to do all of the following actions: to prosecute further combat operations; to obtain a site for an advanced naval or air base; and to deny the use of an area or facility to the enemy.

The principle type of amphibious operation is the amphibious assault. The amphibious assault follows a well-defined pattern. The general sequence consists of planning; embarkation; rehearsal; movement to the objective; and finally, assault and capture of the objective.

PLANNING

The planning phase of an amphibious assault reflects the collected intelligence data on enemy

forces and the territory concerned. It is designed to accomplish several tasks, including the following:

- Embarkation by combat loading methods
- Movement to the amphibious objective area, including defense against air, submarine, and surface attack
- Preassault operations (preparation of the objective area), which include gaining and maintaining local air superiority; destruction of enemy forces and installations by naval aircraft, shipboard guns, and missiles; clearance of mines and underwater obstacles; reconnaissance of beaches by underwater demolition groups; determination of exits inland; and isolation of the objective area
- Ship-to-shore movement by which troops and their weapons, vehicles, and supplies are moved ashore by helicopters and landing craft, or both
- Clearance of beach obstacles and movement inland with tank, artillery, and light and heavy vehicles
- Naval gunfire, missile, and air bombardment in support of the assault and the movement inland
- Landing of supplies and logistic support buildup

Although this list of tasks is incomplete, it illustrates the many requirements that must be considered and resolved. An amphibious assault can succeed only if it is carefully planned, organized, and timed. Planning is the responsibility of the commander and an assigned staff. It demands a complete knowledge of the various combat arms employed and the numerous problems unique to an amphibious operation.

EMBARKATION

In a major amphibious operation, troops are assembled at various ports with their equipment and vehicles. Consistent with extremely detailed loading plans formulated during the planning phase, designated ships arrive in these ports at specified times, ready to embark the landing forces.

Each item of equipment is loaded aboard in reverse order of the priority in which it is desired on the hostile beach. The combat cargo officer of the ship and the commander of the landing force unit to be embarked in that ship prepare individual loading plans for each ship. The commanding officer of the ship reviews and approves the loading plan.

As soon as the ship is moored, it is in all respects ready for loading. All landing craft have been off-loaded, and appropriate cargo-handling gear has been placed in readiness. All cargo booms have been rigged as necessary to handle the material to be stowed in each hold. The advance party of troops boards the ship at the embarkation port and proceeds immediately with the details of loading. When all cargo is aboard, the remainder of troops embark. The ship then leaves its berth and proceeds to an anchorage to await the forming of the convoy. In crowded ports with few facilities, the ship may be loaded while at anchor by a procedure similar to that for ships which are moored. The only difference is that all cargo and equipment must be moved out to the ship by boats, barges, or other lighterage.

REHEARSALS

The schedule for an amphibious operation usually allows for one or more rehearsals carried out under conditions approximating those of the anticipated operation. All units that will take part in the actual operation should participate in the rehearsal. Rehearsals test the adequacy of the plans for the operation as well as the familiarity of all echelons with the plans. They also test the timing of detailed operations, the combat readiness of participating forces, and the effectiveness of communications. If practicable, rehearsals include naval gunfire and air support with live ammunition. Unloading is carried out as determined during planning to the degree needed for planners to effectively test tactical and logistic plans. Unloading tests the operation of the ship-to-shore movement control organization and the functioning of the shore party and all naval components. Following each rehearsal, all levels of command critique the exercise to emphasize lessons learned and to correct mistakes.

MOVEMENT TO THE OBJECTIVE

Every stage of movement of the amphibious task force to the objective area must be planned. That includes departure of participating ships

from their ports of embarkation; their passage at sea; and their approach to, and arrival in, assigned positions in the objective area. The plan must include the movement of ships through rehearsal, staging, and rendezvous areas. Therefore, the movement plan organizes the amphibious task force into movement groups, which proceed along prescribed routes. Usually ships are assigned into fast or slow movement groups, depending on their sustained sea speed. Forces that may not be a part of the amphibious task force provide protection from air, surface, and subsurface attack. Carrier striking forces provide air cover and long-range reconnaissance. In addition, mine warfare ships perform screening duties with the help of other ships suitable for that purpose but with other primary functions. The safety of the amphibious ships with their embarked troops, equipment, and supplies is of paramount importance. Landing forces must arrive at the objective area without critical reduction in their combat potential.

THE ASSAULT

The assault phase begins when the assault forces arrive at their assigned positions in the amphibious objective area. It ends when the mission has been accomplished.

After all the prior planning and rehearsals and final movement into the objective area, the assault commences. The assault phase encompasses the following:

- Preparation of the beach by air strikes and naval gunfire
- Ship-to-shore movement of the landing force by helicopters, landing craft, amphibious vehicles, and landing ships
- Landings in landing and drop zones and on beaches by the assault elements of the landing force
- Inland operations to unify waterborne, helicopter-borne, airborne, and/or air-landed assault forces and to seize the beachhead
- Air support and naval gunfire support throughout the assault
- Landing of remaining land force elements to conduct any operations necessary to complete the accomplishment of the mission

The assault phase is a time when coordination of the operation is extremely critical. The amphibious task force commander, who has responsibility for the overall coordination of air and naval gunfire support, preplans to the greatest extent possible. Delivery of unscheduled fire support on targets of opportunity and unexpected changes in air operations require continuous and close coordination. Only through this coordination can the amphibious task force be assured of maximum effectiveness with a requisite degree of safety. The principles and procedures of fire support coordination haven't changed because of the introduction of nuclear weapons. However, the importance and extent of coordination have increased because of the magnitude of nuclear weapons effects.

The amphibious task force commander eventually shifts control of land operations to the landing force commander. That happens when both commanders agree that the landing force is firmly established ashore and ready to assume full responsibility for subsequent operations. The amphibious operation is then terminated with the amphibious task force remaining in support. The various units of the amphibious task force may then be used for operations in the area or reembarked on the ships from which they were dispatched.

NAVAL TELECOMMUNICATIONS

Communications is the key to command. It involves the transmission and reception of military instructions and information; it is at once the voice of command and the arm of control. It makes coordinated action possible by enabling our ships and aircraft to operate in a purposeful, cooperative effort. Modern naval operations can only be executed with effective communications and a master battle plan. All details of the plan must be communicated to the fighting units. Communications enables those at the highest echelons of command to test missions, objectives, and enemy capability and to determine appropriate courses of action.

Engagement in a full-scale war would allow no time for our nation to obtain quantities of telecommunications equipment and train thousands of personnel to use it. Naval telecommunications, being a function of command, must always be in a condition of preparedness. In the event of hostilities, the operating forces would depend on communications facilities in existence at the time.

A navy that operates on a worldwide scale requires the services of a global communications network. Commanders must be able to pass the word—to communicate—whenever necessary in any mode. They must be able to communicate between and among ships separated by varying distances and from and to ships, shore stations, and aircraft. The ability to communicate makes possible effective command and control. That, in turn, ensures the responsiveness of every mobile nerve center in the fleet to the tactical and strategic needs and services of every other element. A global organization of communications stations with hundreds of radio and landline circuits supports each force of ships. This support means a force of ships is never out of touch with its base of operations. Orders and information affecting the successful outcome of the force's mission are exchanged swiftly and accurately throughout every level of command. The direct result of reliable communications is a tightly directed fighting unit.

Naval messages are sent and received in a variety of ways. The primary method is through the use of electrically transmitted communications; other types include visual, sound, and pyrotechnic communications.

ELECTRICAL

Electrical communications are sent by wave propagation through the atmosphere or by electrical conductors (wires) that connect the sending and receiving equipment. Atmospheric propagation is potentially the least secure method since anyone with a receiver can intercept the transmission. However, most communications circuits use cryptographic devices to distort transmissions.

Speed of delivery is one reason radio is the Navy's most important means of communication. However, it is also the only effective means by which the activities of widespread naval forces can be continuously coordinated.

Radiotelephone (R/T)

Radiotelephone (R/T) microphones are installed in strategic places on ships, such as the combat information center (CIC) and the bridge.

The communications spaces provide transmitter and receiver service to these remote operating positions. Crew members communicate by speaking into a transmitting microphone connected to an assigned frequency.

Although R/T is the least secure form of all radio communications, some systems may now employ cryptographic devices.

Teletype

The mental and manual actions performed by an operator in converting letters to Morse code (and vice versa) are replaced in teletype by electrical and mechanical actions. To transmit a message, the operator types on a keyboard similar to that on a typewriter. Each key that is pressed feeds a sequence of signals into receiving machines causing them to type the message automatically.

Teletype signals may be sent by landline (wire), radio, or satellite communications systems. Both the military services and commercial communications companies such as Western Union use teletype communications.

The primary shipboard use of radio teletype (RATT) is for task-group and ship-to-shore communications. Fleet broadcasts, which formerly used high-frequency (hf) radio transmissions exclusively, are now making use of satellite communications. Automated information exchange systems also use satellites, with attendant high data rates.

Facsimile

Recent technological improvements have made commercial facsimile (FAX) machines a common and relatively inexpensive piece of office equipment. Many commands use these to transmit urgent correspondence over standard or secure telephone lines. The "fuzzy" message transmission quality is exchanged for almost instantaneous printed copies of graphic or typewritten documents.

Military FAX machines are used to transmit photographs, charts, and graphic or pictorial intelligence information electronically. Signals are transmitted either by landline or by radio.

FAX systems are not intended as replacements for other standard communications methods. They are a useful supplemental system for rapid communications.

Fleet Broadcasts

Radio traffic is sent to the fleet by two methods: broadcast and receipt. The first is a "do not answer" method; the second, as its name implies, requires a receipt from addressees for each message. The broadcast method allows the fleet to preserve radio silence, which is a great advantage from the standpoint of security.

Civilian and naval broadcasts have some similarity. Commercial stations in the broadcast band transmit programs to radio receivers in the homes in their communities. Likewise, Navy communications stations broadcast messages to fleet units in their particular geographic areas. The term *broadcast*, in fact, originated in naval communications.

The resemblance between Navy commercial stations ceases here, however. Information broadcast by naval communications stations is contained in chronologically numbered messages assigned to the ships. Fleet units copy the messages and check the numbers to ensure they have a complete file of all messages they should have received.

Automated systems now key fleet broadcasts. Messages are broadcast in their order of precedence. If the automated system receives a higher-precedence message while transmitting a lower-precedence message, it may interrupt the latter to transmit the higher-precedence message.

All ships copy all messages addressed to them that appear on the broadcast schedule they are guarding.

Fleet broadcasts use satellites as their primary transmission media. High-frequency (hf) radio transmission provides broadcast services to ships that are unable to copy the satellite systems.

Satellite Communications

A satellite communications (SATCOM) system is one that uses earth-orbiting vehicles or

satellites to relay radio transmissions between earth terminals.

A typical operational link involves a satellite and two earth terminals. One station transmits to the satellite on a frequency called the up-link frequency. The satellite amplifies the signal, translates it to the down-link frequency, and then transmits it back to earth where the signal is picked up by the receiving terminal.

The Commander, Naval Telecommunications Command (COMNAVTELCOM), is designated the communications manager for Navy-assigned satellite systems. The responsibilities of the communications manager include operating the earth terminals and publishing *Satellite Communications Operating Procedures* (NTP-2).

Commander, Naval Space Command (COMNAVSPACECOM), is the operational manager for Navy satellites. The operational manager plans the location of spacecraft and fixed earth terminals and allocates satellite capacity, power, bandwidth, and operating frequencies.

The Navy uses two primary SATCOM systems:

Ž Long-haul (long-distance) communications takes place via the defense satellite communications system (DSCS), which is managed by the Defense Communications Agency (DCA). This high-capacity global system uses satellites equally spaced around the world operating on superhigh frequencies (shf). Ships and stations located anywhere on the earth from 70 degrees north latitude to 70 degrees south latitude have access to one of these satellites.

Ž The fleet satellite communications (FLTSATCOM) system operates at ultrahigh frequency (uhf), making possible the use of relatively low-cost terminals and simple antennas. Leased satellites (LEASAT) are part of this system.

Ž FLTSATCOM provides the primary means of Navy tactical satellite ship-shore-ship communications over the officer in tactical command information exchange subsystem (OTCIXS) and the tactical data exchange subsystem (TADIXS). The common user digital information exchange system (CUDIXS) and the naval modular automated communications system (NAVMACS) combine to form a general-service message traffic network.

Many current satellites are programmed to be phased out by a new generation of extremely high-frequency (ehf) satellites. The military strategic tactical and relay (MILSTAR) system is a joint service program expected to be operational in the 1990s.

VISUAL

Visual communications are the preferred means for communicating at short range when weather conditions permit. In reliability and convenience, visual communications often are the equal of radio and under certain circumstances are more secure than radio. For example, omnidirectional radio transmissions may be intercepted by many undesired listeners, whereas unidirectional visual signals are limited to observers positioned along the line of sight.

Visual signaling systems include flaghoist, flashing light, and semaphore.

Flaghoist

Flaghoist signaling can be a rapid and accurate communications method during daylight hours. International alphabet flags, numbered pennants, and special meaning flags can coordinate tactical maneuvers and ships' movements without radio transmissions.

All sailors are expected to recognize everyday flags. Sailors rely on the safety and informational messages relayed by these flags, such as "divers in the water" or "captain's on board," to help them in their daily routine.

Flashing Light

Flashing light uses visible beams (or infrared light during tactical nighttime communications) to transmit Morse Code letters through an on/off method. Directional lights are pointed so that only the addressee can read the message. Omnidirectional lights may be located above the ship's superstructure for all ships within range to copy the message.

Semaphore

Semaphore is a communications medium by which persons signal with two hand flags, moving

their arms through various positions to represent letters, numerals, and special signs.

Semaphore and flashing light can be used interchangeably for many purposes. Semaphore is more rapid for short-distance transmission in clear daylight and may be used to send messages to several addresses at once if they are in suitable positions. Because of its speed, semaphore is better adapted to the sending of long messages than are other visual methods. When radio silence is imposed, semaphore is the best substitute for handling administrative traffic. It is more secure than a light or radio because it provides less chance for interception by unauthorized persons.

SOUND

Sound communications systems include whistles, siren, bells, and acoustics. Ships use the first three to transmit emergency warning signals (such as air-raid alerts) and navigational signals prescribed by the rules of the road. In wartime, ships in convoy use these three systems to communicate with each other.

An underwater sonar system called Gertrude is part of acoustic submarine communications. Used primarily for hailing NATO ships, it may be used for radiotelephone or carrier-wave (c/w) transmission.

PYROTECHNICS

Pyrotechnics is the use of ammunition, flares, or fireworks to signal a message or to illuminate or mark targets. Most pyrotechnics for signaling are of the "fireworks" variety. Common sources are marine illumination cartridges, colored shell bursts (parachute flares), aircraft parachute flares, reman candles, and float-type flares. The meaning of a pyrotechnic signal depends on the color instead of the type of pyrotechnic employed. The authorized use of pyrotechnics for communications is, in general, limited to emergency signals.

SUMMARY

The preceding discussion of naval warfare operations demonstrates that extensive planning is required if a mission is to be successful. When all of the warfare components function together,

close cooperation must be maintained between them. To a large extent, that is achieved before an operation is conducted.

One vital element that must be present throughout the operation, however, is communications. All participants in an operation must be able to communicate with each other.

All of these components function as members of the Navy team. Trying to conduct a successful mission without any particular one of the components would be disastrous. However, when all function together as one, our Navy can achieve its assigned missions.

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JACOB'S LADDER

A JACOB'S LADDER IS A PORTABLE LADDER MADE OF ROPE OR METAL USED PRIMARILY TO HELP PERSONNEL BOARD SHIP. ORIGINALLY, THE JACOB'S LADDER WAS A NETWORK OF LINE LEADING TO THE SKYSAIL ON WOODEN SHIPS. THE NAME ALLUDES TO THE BIBLICAL JACOB REPUTED TO HAVE DREAMED OF A LADDER THAT REACHED INTO HEAVEN.

ANYONE WHO HAS EVER TRIED CLIMBING A JACOB'S LADDER WHILE CARRYING A SEABAG CAN APPRECIATE THE ALLUSION. IT DOES SEEM THAT THE CLIMB IS LONG ENOUGH TO TAKE ONE INTO THE NEXT WORLD.

